Measure: Enhanced Direct Load Control in Commercial Buildings (G6a)

Require by ordinance that all new commercial buildings be fitted with dynamic load control technology, such as smart electricity meters, at the time of construction. Developers will be encouraged to work closely with TEP to take advantage of possible future incentives for deployment of direct load control systems or smart meter technology. The systems installed must provide real-time electricity consumption information to building tenants.

The City will also work with TEP to promote the advantages of voluntary direct load control retrofits to existing commercial buildings with the goal of having 10% of existing, occupied commercial space participate by end of 2013.

Studies where direct load control systems such as smart meters have been deployed indicate an average energy savings of as high as 12%/year as a result of changes in consumer energy consumption behavior due to information from smart meters.

Emission reduction potential by 2020:	33,301 tCO_2e/yr.
Percentage of goal (2012):	NA
Percentage of goal (2020):	2.5%
Total annual average implementation costs:	$10,133
Entity that bears the costs of implementation:	Commercial / industrial building owners
Cost/Savings per tCO_2e through 2020:	Savings $133/$tCO_2e$
Net annual savings in 2020:	$8.32 million
Entity that realizes the financial return:	Commercial and industrial businesses
Equitability (progressive/regressive, income/revenue neutral, etc):	Neutral
Potential unintended consequences:	0

Background information:

Direct load control systems, which include but are not limited to smart meters, represent the next generation of electricity meter. They signal the end of estimated utility bills and monthly meter readings by providing customers and energy suppliers with accurate information on the amount of energy being used on a real or near real-time basis. The key attribute advanced with smart metering is the concept of dynamic utility pricing.

One simple approach is time-of-use-pricing, where demand-based fixed pricing bands are established by the utility and consumers can choose to modify demand with these pricing bands (peak, off-peak, shoulder) in mind. A second form of dynamic pricing is real-time pricing with prices altered on a systematic, scheduled basis (hourly, half-hourly) and meters receiving and displaying the price to the customer who can moderate consumption behavior accordingly.

In each case, consumers have information that enables more informed decision making and choices as to times and amounts of energy they wish to use. Reductions in energy demand are almost always achieved as consumers respond to the availability of information from smart energy meters.

Status Quo / Business as Usual:

At the beginning of 2009, the most recent year with full-year data, there was an estimated 103.5 million square feet of commercial (industrial, retail, office) space in Tucson.[1] Construction of an estimated 700,000 additional square feet of combined retail, office, and industrial space was expected to be completed in 2010.[2]

Deployment of direct load control systems or any other type of smart metering in the existing 103.5 million square feet of commercial sector in Tucson, or in the new construction sector, is not yet common. Thus new commercial building and most all existing commercial building tenants (which have not independently adopted some form of smart metering on their own) cannot take advantage of accurate and timely pricing signals for electricity consumption and miss the cost savings that these price signals offer as described in more detail below.

Tucson Electric Power has two forms of time-of-use metering available to commercial customers. The first is called Power Shift. A Power Shift meter tracks the number of kWh a customer uses and the time used. The time of use meter installed lets TEP know how much electricity was consumed during peak, shoulder, or off-peak periods so it can apply the appropriate rate for each period's consumption.[3]

The second type of program TEP offers is called DemandSMART[4] that it makes available to commercial, institutional, and industrial customers in its service area. Program participants voluntarily reduce their electric consumption during times of peak

electricity demand or high wholesale electricity prices and receive recurring payments in return for participating during these events.

Neither program offers the advantages of dynamic real-time pricing. The Power Shift metering only provides immediate information in one direction, to the utility. Information back to the customer comes later at billing, so the customer does not receive the immediate time-of-use price signals possible under advanced smart meter approaches.

DemandSMART customers receive compensation based on reduced electricity demand during utility-defined events but there is no immediate price signal on savings to alert the customer just how much peak or other event pricing periods cost compared to off-peak usage.

Description of Measure and Implementation Scenario:

This measure recommends that the City of Tucson require by ordinance that developers of all new commercial buildings, in consultation with Tucson Electric Power, install a direct load control system (or multiple systems if the property is to be used by more than one tenant) in commercial properties they build before occupancy may take place.

The systems should be able to provide dynamic pricing signals to tenants and allow for tenant-choice on whether to participate at a given time and at a specified price. This measure is intended to spur energy efficient behavior of tenants in commercial space going forward from the time of an ordinance. Energy and cost savings would accrue to landlords or tenants.

Based on our conservative forecast for the addition of new commercial buildings in Tucson, we build this analysis off of a projected 1 million additional square feet/year through 2020.

In conjunction with this measure, the City and TEP should create an aggressive direct load control system outreach and education program to all commercial energy tenants and landlords with the goal of having 10% of the total existing commercial square footage in the City being served with direct load control systems two years after program implementation.

Has the Measure been implemented elsewhere and with what results:

The total number of time-of-use or other forms of smart meters deployed around the world today is approximately 80 million units. This number is expected to triple in the next three to four years.[5] In Europe, Italy and Sweden have managed a near-100% penetration level of smart meters through aggressive deployment strategies. About 13 million smart meters have been installed in the United States, representing a penetration level of about 9%. This number is expected to increase to 30 million by 2012 and reach 50 million by 2014-15.[6]

In the U.S., a study by the American Council for an Energy Efficient Economy (though addressing the residential sector) estimated that a similar 12% savings would be likely on an annual basis as a result of smart meter deployment and subsequent reductions in energy use they inspire.[7]

In Miami-Dade County FL, the "Energy Smart Miami" program is a smart grid partnership involving the city, GE, Cisco, the local utility, and Silver Spring data communications company. The program is designed to overhaul the city's electrical grid and includes deploying smart meters in every home and most businesses. [8]

In the U.K., where smart meter deployment is occurring rapidly, The Carbon Trust undertook smart metering trials and the results showed that smart energy meters, when combined with consumption data and energy-saving advice, gave potential energy-savings of 12%/year.[9] In a country with already high energy prices compared to the United States serving to drive energy-efficient behavior, this percent of added energy savings is significant.

San Diego Gas and Electric began installing its first batch (200,000) of smart meters in March of 2010. The utility reports that its research shows customers typically cut their energy consumption by at least 5-10% when they know how much they are using.[10]

Energy/Emission analysis:

Existing Buildings

The commercial and industrial sectors (excluding TEP's natural gas combustion to produce electricity) in Tucson were responsible for a combined 9,490,164 MMBtu of electricity consumption in 2008.[11] This converts to 2,781,407,971 kWh/year.

If ten percent of the existing Tucson commercial / industrial space achieved a 12% reduction in electricity use as a result of smart meter installation, the annual energy savings would total 33,376,895 kWh/year (2,781,407,971 kWh x .10 x.12).

We project that half of the meters could be installed in 2011, creating savings of perhaps 25% of a full year's potential, or ~8.34 million kWh for the year. The other half of meter installations would occur in 2012, so we estimate that 75% of the potential savings are achieved in 2012, or ~25.7 million kWh. The full 33.4 million kWh savings begin in 2013.

Accumulated savings to 2020 in existing buildings: 292 million kWh.

The meters are assumed to have a 20-year life. Over the lifetime of the meters, ~642.5 million kWh would be saved.

Greenhouse gas emission reductions associated with this amount of energy savings total 22,705 tCO_2e in 2012 and 30,274 tCO_2e/year (full implementation) from 2013 to 2020. Cumulative savings to 2020 total ~265,000 tCO_2e.

New Buildings

Smart meters would be required on all new commercial and industrial buildings starting in 2012.

We project the addition of 1 million square feet per year (2009 commercial development level), which is ~1% of the existing inventory that uses 2.78 billion kWh/year. Therefore, new buildings would have an energy usage of 27,814,079 kWh/year.

A 12% savings from behavior changes as a result of mandatory smart meter installation would save 3,337,689 kWh/year. Greenhouse gas emission reductions associated with this amount of energy savings total 3,027 tCO_2e.

Depending on the recovery of the commercial new construction market sector, future new construction could likely exceed 1 million square feet per year and projections can be made then of expected energy, cost, and GHG reduction.

Cumulative savings by 2020 amount to 180.24 million kWh. Greenhouse gas savings over the 2012-2020 period totals 81,739 tCO_2e.

Total Electricity Savings

Combining energy savings from the two program components produces 29 million kWh in 2012 and 36.7 million kWh in 2020. Through 2020, the savings amount to 330.4 million kWh

The kWh savings in 2012 translates to 25,705 tCO_2e and 2020 savings of 33,301 tCO_2e. Through-2020 savings total 401,112 tCO_2e.

Climate Change Impact Summary in tCO_2e:

COT 1990 Citywide GHG emissions (baseline):	5,461,020
MCPA 7% reduction target for COT:	5,078,749
2012 BAU GHG emissions projection:	7,000,000
2020 BAU GHG emissions projection:	7,343,141
GHG emissions reduction to meet 7% goal (2012):	1,921,251
GHG emissions reduction to meet 7% goal (2020):	2,264,392
Contribution of this Measure:	25,705 in 2012 and 33,301 in 2020

Economic analysis:

Commercial smart meters have costs in the $240 - $300 range.[12] For our purposes here, we will use the $450 cost figure to attempt to include all associated expenses beyond the meter itself. We recognize that meter prices may decline, but installation costs and sophistication factors may combine to keep prices stable.

Under the mandatory element of this measure, the cost of a smart meter would be borne by the developer/landlord and would be recoverable through lower energy costs (if owner-occupied or if tenants' utility costs are absorbed into lease payments) or higher rents (if tenants pay their own utility bills and receive direct benefit from the information provided through smart metering).

We assume that 200 commercial properties, covering 10% of the 103,000,000 square feet of existing commercial / industrial property in Tucson, participate and pay $450 each for a smart electricity meter. Total costs for the existing building meters would be $90,000. Regarding new buildings, we assume that twenty commercial / industrial smart meters are installed each of 9 years year at a cost of $9,000/year.

Energy savings per customer varies widely depending on the type of building and a customer's level of engagement and motivation. However, based on the 12% projected energy savings and electricity prices increasing from today's $0.087 commercial TEP summer rate at 2.4%/yr, commercial / industrial tenants would save ~$2.5 million in 2012, steadily increasing to ~$6.8 million in 2020, adding up to ~$44.7 million accumulated savings by 2020.[13]

If the measure continues to require installation of smart meters past 2020 in all new commercial buildings, businesses will have saved ~$252 million by 2040.

Net Economic Impact

The net savings of this measure:

In 2020:	$ 6.82 million
Through 2020:	$44.5 million
Lifetime of meters:	$252.27 million

The cost savings per tCO_2e saved:

In 2020:	$119
Through 2020:	$111
Lifetime of meters:	$143

Considering the economic multiplier of 1.5 applied to saved energy costs, the positive impact on the Tucson economy is projected to be:

In 2020:	$10.2 million
Through 2020:	$66.7 million
Lifetime of meters:	$378.4 million

Co-benefits:

Co-benefits of the deployment of smart meters include:

1) Evening out often lumpy consumer demand for electricity which creates the need for costly, surplus stand-by generating units
2) Improved accuracy in billing and the sharp reduction of estimation errors and potential overcharging of consumers
3) Improved accuracy in utility forecasting of energy demand at different times of day
4) More competitive local businesses as energy costs decline relative to businesses not capturing energy efficiencies

Equitability:

The deployment of smart meters would likely be considered a progressive measure. The energy savings for businesses occupying smart-metered commercial space and responding to price signals would likely have more value to small businesses rather than larger ones who enjoy more of a volume-based business model. In all cases, the cost of energy meters, if borne by the tenant (rather than a utility, as in some programs) would be recouped through cost savings as result of behavioral changes in energy use.

Potential unintended consequences:

The complexity of the most dynamically-priced billing made possible with smart meters will be more difficult for customers to calculate themselves. Customers would have to rely on whatever software or online application a utility provides for bill tracking via computer. Customers will also need to trust energy companies to protect their usage data, calculate bills properly, and to charge the correct price at all times based on demand.

There has also been some concern that smart meters create the potential for computer hackers to target meters and any connected appliance (home computers) for criminal or vandalism purposes.[14] Protection of privacy concerns are being addressed through the development of national standards for smart meters intended to prevent such hacking. In addition, rules preventing utilities from sharing time-of-use energy consumption data with third parties is also being proposed.

Endnotes

[1] Pima Association of Governments. http://pagnet.org/RegionalData/EconomicSnapshots/NonResidentialRealEstate/tabid/605/Default.aspx

[2] Picor. December 29, 2010. http://www.picor.com/randp/index.cfm

[3] Tucson Electric Power. http://www.tep.com/Green/Business/tou.aspe

[4] Tucson Electric Power. http://www.enernoc.com/resources/files/tep-ds-faq.pdf

[5] "MDMS Expected to Grow in Step with AMI." Renew Grid. December 2010.

[6] Ibid.

[7] GreenBiz.com. http://www.greenbiz.com/news/2010/07/01/smart-meters-alone-wont-reduce-energy-use-study-says?page=full

[8] "Google Partners with Eight Utilities in Smart Meter Projects to Track Energy Use Online." http://www.greenbiz.com/print/25305

[9] Catalyst Commercial Services. http://www.catalyst-commercial.co.uk/energy_extras/smart_meters/

[10] Op cit. (4)

[11] Regional Greenhouse Gas Inventory. Pima Association of Governments. October 2010.

[12] The Oil Drum. http://www.theoildrum.com/node/5592

[13] TEP. http://www.tep.com/Business/Programs/PricingPlans/tariffs.asp.

[14] PhysOrg.com. http://www.physorg.com/news176703307.html